

Claims

1. A switch for use in circuits which interact with electromagnetic radiation, comprising:

at least one switch comprised of:

5 a substrate for supporting components of the switch,
a first conductive element on said substrate for connection to a first component of said circuit,

a second conductive element on said substrate for connection to a second component of said circuit, and

10 a switch element made up of a switching material on said substrate, and connecting the first conductive element to the second conductive element, said switching material comprised of a compound which exhibits a bi-stable phase behavior, and switchable between a first impedance state value and a second impedance state value by application of energy thereto, affecting current flow
15 between said first conductive element and said second conductive element resulting from a change in the impedance value of said compound.

2. The switch of claim 1, wherein said first and second impedance state values are such that at one value the switch is conductive, and at the other value the switch is from less conductive to being non-conductive.

20 3. The switch of claim 1, further comprising an energy source connected to the switch for causing said change in impedance values.

4. The switch of claim 1, further comprising separate leads connected to said switch for connection to an energy source.

25 5. The switch of claim 4, further comprising an energy source connected to the switch through said leads for causing said change in impedance values.

6. The switch of claim 1, wherein said first conductive element and said second conductive elements are part of a circuit for coupling with electromagnetic waves which induce current flow in said first conductive element and said second conductive element.

30 7. The switch of claim 1, wherein said switching material comprises chalcogenide alloy.

8. The switch of claim 7 wherein said alloy comprises $\text{Ge}_{22}\text{Sb}_{22}\text{Te}_{56}$.
9. The switch of claim 1, wherein said switching material is a thin film material.

10. The switch of claim 1, wherein said switching material is a reversible
5 phase change material having a variable impedance over a specified range which is dependent on the amount of energy applied to the material.

11. The switch of claim 1, wherein said first and second conductive elements are the same material as said switching material.

12. The switch of claim 1, wherein said first and second conductive
10 elements are the same material as said switching material and said switch element is shaped to switch its phase state to the second impedance state in response to an application of energy to said switch while said conducting elements remain in said first impedance state, and remains in the second impedance state without continuing the application of energy.

13. The switch of claim 12, wherein the switch element is narrower than
15 the first and second conductive elements.

14. The switch of claim 12, further comprising separate leads connected to said switch for causing said change in impedance values.

15. The switch of claim 1, wherein said switch element is shaped to switch
20 its phase state to the second impedance state in response to an application of energy to said switch, and remains in the second impedance state without continuing the application of energy.

16. A circuit for coupling to electromagnetic waves for having current flow induced throughout the circuit, comprising:

25 a substrate for supporting components of the circuit; and
at least one switch comprising;

(a) a first conductive element on said substrate for connection to a first component of said circuit, (b) a second conductive element on said substrate for connection to a second component of said circuit, and (c) a switch element
30 made up of a switching material on said substrate, and connecting the first

conductive element to the second conductive element, said switching material comprised of a compound which exhibits a bi-stable phase behavior, and switchable between a first impedance state value and a second impedance state value by application of energy thereto, affecting current flow between said first
5 conductive element and said second conductive element resulting from a change in the impedance value of said compound.

17. The circuit of claim 16, wherein said first and second impedance state values are such that at one value the switch is conductive, and at the other value the switch is from less conductive to being non-conductive.

10 18. The circuit of claim 16, further comprising an energy source connected to the switch for causing said change in impedance values.

19. The circuit of claim 16, further comprising separate leads connected to said switch for connection to an energy source.

15 20. The circuit of claim 19, further comprising an energy source connected to the switch through said leads for causing said change in impedance values.

21. The circuit of claim 16, further comprising a grid of said first and second conductive elements that are spatially arranged to form a frequency selective surface array.

20 22. The circuit of claim 21, further comprising a plurality of said switch elements throughout said array for varying current flow induced in the array by impinging electromagnetic radiation.

23. The circuit of claim 21 further comprising at least one switch element interconnected within said array for varying current flow induced in the array by impinging electromagnetic radiation.

25 24. The circuit of claim 16, wherein said switching material comprises chalcogenide alloy.

25. The circuit of claim 24, wherein said alloy comprises $\text{Ge}_{22}\text{Sb}_{22}\text{Te}_{56}$.

26. The circuit of claim 21, wherein said switching material is a thin film material.

27. The circuit of claim 16, wherein said switching material is a reversible phase change material having a variable impedance over a specified range which is dependent on the amount of energy applied to the material.

5 28. The circuit of claim 16, wherein said first and second conducting elements are the same material as said switching material.

29. The circuit of claim 16, wherein said first and second conducting elements are the same material as said switching material and said switch element is shaped to switch its phase state to the second impedance state in response to an application of energy to said switch while said conducting elements remain in said
10 first impedance state, and remains in the second impedance state without continuing the application of energy.

30. The circuit of claim 29, wherein the switch element is narrower than the first and second conductive elements.

31. The circuit of claim 16, further comprising separate leads connected to
15 said switch for causing said change in impedance values.

32. The circuit of claim 16, wherein said switch element is shaped to switch its phase state to the second impedance state in response to an application of energy to said switch, and remains in the second impedance state without continuing the application of energy.

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